REMARKS

Claims 1, 3 - 11 and 13 - 20 remain active in this application. Claims 2 and 12 have previously been canceled. The specification has again been reviewed and minor editorial revisions made where seen to be appropriate. No new matter has been introduced into the application.

Claims 1, 3, 4, 6 - 8, 11, 13, 14, and 16 - 18 have been rejected under 35 U.S.C. §103 as being unpatentable over Nishizawa et al. in view of Maley et al. (Abstract only) and Abelson et al. (Abstract only) and claims 5, 9, 10, 15, 19 and 20 have been rejected under 35 U.S.C. §103 as being unpatentable over the same combination of references in view of the further teachings of Dubbelday et al. These grounds of rejection are substantially repeated from the previous office action and are again respectfully traversed for the reasons of record which are hereby fully incorporated by reference and the further remarks provided below, particularly since no *prima facie* demonstration of obviousness has been made or can be made based on the references relied upon in regard to any claim in the application and the Examiner continues to effectively ignore numerous explicit recitations of the claims. Further and for that reason, it is also respectfully submitted that the references relied upon are substantially irrelevant to the distinguishing features and meritorious effects of the invention and, in any event, teach or suggest nothing more of relevance to the invention than is discussed in the "Background" section of the present application.

Specifically, the Examiner cites Nishizawa et al as teaching the monitoring of silicon growth and a control loop for controlling introduction of reactant gases while admitting that the monitoring is not performed by measurement of the partial pressure of

hydrogen; for which reliance is placed by the Examiner on Maley et al. and Abelson et al. However, it is respectfully submitted that the Examiner is largely incorrect in these observations and reliance on Nichizawa et al. and supplemental references, particularly as a reason for adherence to the stated grounds of rejection. In fact, Nishizawa et al. is principally concerned with the deposition of a *compound* semiconductor (see column 1, lines 37 - 55) such as GaAs, in which the proportions of constituent elements is fixed by a chemical reaction rather than a single element (e.g. silicon) or an alloy (e.g. SiGe) in which the proportions of the material are variable and are of extreme importance to the electrical characteristics of the film, to which the present invention is directed. The sole mention of applicability to silicon appears to be at column 6, lines 37 - 42, in the context of much different reactant materials. Monitoring of film growth is performed by a mass analyzer in the form of a multiple ion sensor 26 (see column 7, lines 29 - 34 to detect the reaction product, methane rather than hydrogen, and residual TMG and AsH_3. Such an arrangement is discussed and shown to be substantially irrelevant to the purposes, principles and constitution of the invention at page 4, lines 12 - 27, particularly since the precursor materials do not produce "evolution of a *distinctive amount* of *hydrogen relative to mass flow rate* upon deposition *alone or in combination with another constituent material* of said precursor material" (emphasis added), "adsorbing an activated species" (since molecular GaAs is formed and deposited) or "determining a partial pressure of hydrogen in residual gases as said activated species is deposited" and, in any case, the proportions of Ga and As are fixed by the reaction to form a compound while the proportionate composition of alloys (and elements) can vary between 0% to 100% for any constituent material.

Further, such detection is directed to determination of substantial completion of the reaction of TMG and AsH_3 to form a layer of a given (e.g. molecular) thickness and thickness of the film is determined by the number of repetitions of the reaction/deposition process as shown in Figure 2 and described at column 4, line 52 to column 5, line 42, of Nishizawa et al. where it is noted that the number of deposition cycles *and the amount of reactant gases introduced in each cycle are both predetermined* for a film of a desired thickness. Therefore, Nishizawa et al. does not control either mass flow or temperature of the process or any other process parameter based on any measurement and, further, no control is performed in a closed loop manner as the Examiner asserts. Therefore, Nishizawa et al., as noted above, fails to answer *any* recitation of claims 1 or 11. Nishizawa et al. is not even relevant to an environment where the meritorious effects of the invention are of importance or needed, much less where its principles or its methodology or constitution can be exploited to advantage to produce effects not previously achieved.

These *manifold* deficiencies of Nishizawa et al. to answer the explicit recitations of the claims (in addition to the failure of Nishizawa et al. to teach or suggest monitoring of hydrogen, as the Examiner admits) are not mitigated by Maley et al. and/or Abelson et al., particularly as to subject matter which could possibly support a *prima facie* demonstration of obviousness of any claim in the application. First of all. it is respectfully pointed out that both Maley et al. and Abelson et al. are directed to deposition of *amorphous hydrogenated* silicon films (a-Si:H) in which a *variable* amount of hydrogen is incorporated into the film as it is deposited. Note that the Abelson et al. Abstract explicitly states that hydrogen is evolved when the hydrogen fraction in the growth flux (e.g. the

input precursor gas) exceeds the hydrogen incorporation rate into the film. That is, while it is usually the case that some hydrogen will be evolved, it will be evolved only to the extent the amount of hydrogen provided to the deposition system exceeds the *variable* amount of hydrogen incorporated in the film. Therefore, deposition of a film in which hydrogen is incorporated into the deposited film is *inherently incapable* of "producing evolution of a *distinctive amount of hydrogen* relative to mass flow rate". Since this property of the film deposition process which is explicitly recited in the claims and characteristic of deposition of monocrystalline and polycrystalline films and exploited by the invention as a basic principle thereof is not presented in a case where significant hydrogen is incorporated into the film, it is clear that both Maley et al. and Abelson et al. are necessarily directed to substantially different environments than the invention and Nishizawa et al. (or Dubbelday et al.) and are non-analogous thereto (and to the invention) for the simple reason that any measurement of the amount of evolved hydrogen can only principally reflect the amount of hydrogen incorporated into the film and thus cannot be a "signature" of any other parameter of a deposition process. In this regard, while the amount of evolved hydrogen may be detected in Abelson et al. such detection is evidently for the purpose, as stated, of "determining a lower bound on the rate of reactive hydrogen impingement on the growing surface" which is found based "on the partial pressure of hydrogen in the discharge" to be about one reacted hydrogen per incorporated silicon ... for typical deposition conditions". Therefore, it does not appear that the amount of hydrogen impinging on or incorporated into the deposited film (or any other deposition parameter) is controlled in response to measurement of hydrogen partial pressure and Abelson et

al. does not clearly state even that the amount of hydrogen incorporation is controllable and appears to infer that the rate of hydrogen impingement on the deposition surface necessary for incorporation of hydrogen into the film is substantially constant over a significant range of "typical deposition conditions".

Maley et al. appears to be even less relevant to the invention than Abelson et al. Specifically, the monitoring method used is "IR reflectance spectroscopy" (the problems with optical monitoring techniques, in general, having been discussed in the paragraph bridging pages 3 and 4 of the present specification) and the information of interest is "the nature of Si-H bonding in *amorphous, hydrogenated* silicon films formed by *sputtering*; a stretching of the bonds and a systematic dependency of the stretching on both film thickness and hydrogen partial pressure during deposition being found. There is no indication of monitoring of hydrogen partial pressure to control precursor material mass flow, deposition rates or proportionate composition or to monitor or control process temperature in a more direct manner as recited in the present claims. Therefore, it is clear that Maley et al. does not supplement the teachings of Nishizawa et al and/or Abelson et al. at any of the points of deficiency of those references to answer the explicit recitations of the claims as noted above.

Accordingly, it is respectfully submitted that, at best, Maley et al. and Abelson et al. merely *mention* hydrogen partial pressure which is, in any case, irrelevant to the (e.g. methane) chemical reaction product of Nishizawa et al. and none of these references teach or suggest controlling any deposition process parameter, much less temperature or precursor material mass flow in response to measured hydrogen partial pressure. Moreover, none are directed to a deposition process in which "a distinctive amount of

hydrogen relative to mass flow rate" will be evolved and are thus clearly unrelated and irrelevant to even the most basic principles underlying the present invention, as claimed. Therefore, it is abundantly clear that the Examiner has not made and cannot make a *prima facie* demonstration of the obviousness of any claim based upon the teachings or suggestions contained in Nishizawa et al., Abelson et al. and/or Maley et al. Moreover, these references do not provide evidence of a level of ordinary skill in the art which would support a conclusion of obviousness as the Examiner has asserted since they do not lead to an expectation of success in providing an enhanced and, more importantly, direct technique for controlling critical process parameters of temperature or mass flow rate to regulate film deposition rate and/or composition *in real time*, as claimed.

In regard to the ground of rejection based on the above combination of references in view of the further teachings of Dubbelday et al., it is respectfully submitted that, at best, Dubbelday et al. merely mentions the deposition of an SiGe film (on passivated sapphire rather than crystalline silicon) but does not teach or suggest monitoring of hydrogen partial pressure, much less controlling temperature or mass flow of precursor material in response thereto or even recognize that "producing evolution of a distinctive amount of hydrogen relative to mass flow rate upon deposition alone or in combination with another constituent material of said precursor material" occurs during SiGe deposition from silane and/or germane or that such a phenomenon can be exploited in any way or for any useful purpose. For that reason, Dubbelday et al. cannot provide evidence of a level of ordinary skill in the art which would support a conclusion of obviousness or supplement any combination of the references discussed above to do so. Therefore, it is

also respectfully submitted that the Examiner has not made and cannot make a *prima facie* demonstration of the obviousness of any claim based upon the teachings or suggestions contained in Nishizawa et al., Abelson et al., Maley et al. and/or Dubbelday et al.

In summary, it is clear that the grounds of rejection stated by the Examiner are substantively in error, particularly in substantially ignoring numerous explicit recitations of the claims which are not, in fact, answered by the references relied upon. The Examiner has thus failed to make a *prima facie* demonstration of obviousness of any claim in the application and, moreover, has not even addressed a basic, underlying principle of the invention, explicitly recited in the claims, which is necessarily not involved in or provided by either of the Abelson et al. and/or Maley et al. references cited and thus do not and cannot, in fact, teach or suggest the features admitted to be absent from Nishizawa et al. in addition to other deficiencies thereof evidently not recognized by the Examiner. Accordingly, it is respectfully requested that the grounds of rejection based on these references be reconsidered and withdrawn.

It is also respectfully submitted that the finality of the present office action is premature. While no additional prior art was applied and minor amendments were made in the previous response, it is respectfully submitted that finality of any action is premature when a *prima facie* demonstration of the propriety of a rejection has not been made in either the current or previous office action. Therefore, reconsideration and withdrawaal of the finality of the present office action is also respectfully requested.

Since all rejections, objections and requirements contained in the outstanding official action have been fully answered and shown to be in error and/or inapplicable to the present claims, it is respectfully

submitted that reconsideration is now in order under the provisions of 37 C.F.R. §1.111(b) and such reconsideration is respectfully requested. Upon reconsideration, it is also respectfully submitted that this application is in condition for allowance and such action is therefore respectfully requested.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Deposit Account No. 09-0458 of International Business Machines Corporation (E. Fishkill).

Respectfully submitted,

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